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[54] **INSULATION DISPLACEMENT ELECTRICAL TERMINAL ASSEMBLY**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**[6] **H01R 4/24**

[52] **U.S. Cl.** **439/397**

[58] **Field of Search** 439/395, 397, 396, 856

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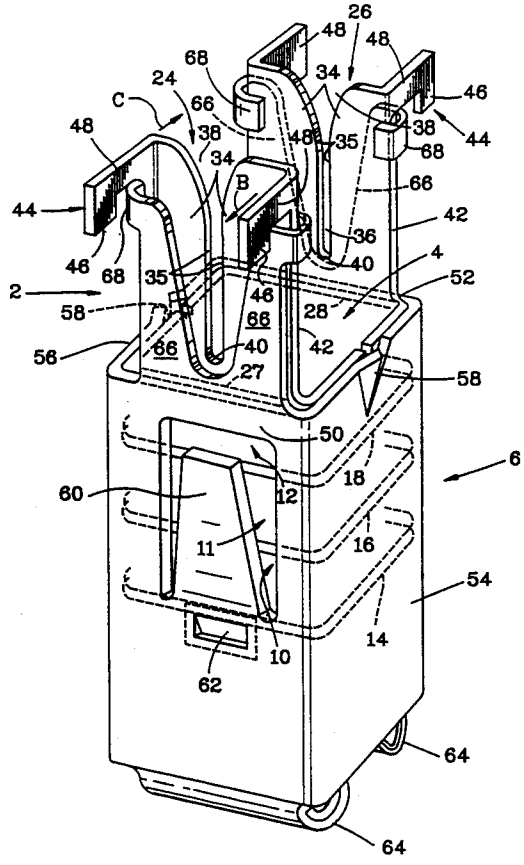
[57] **ABSTRACT**

An electrical terminal assembly comprising an electrical terminal has an insulation displacement contact having a base portion from which extend a pair of coplanar arms defining a slot for receiving an insulated lead. A restraining flange projecting from the top of each arm at right-angles to its plane terminates in a foot which is received in a well in a housing having a cavity receiving the terminal assembly. The well is dimensioned to allow the foot to move parallel to the plane of the arms but not at the right angles thereto. The arms cannot, therefor, twist about their longitudinal axes under the lead insertion force, but can move in their own planes to accommodate the metal cone of the lead as it is forced into the slot.

18 Claims, 5 Drawing Sheets



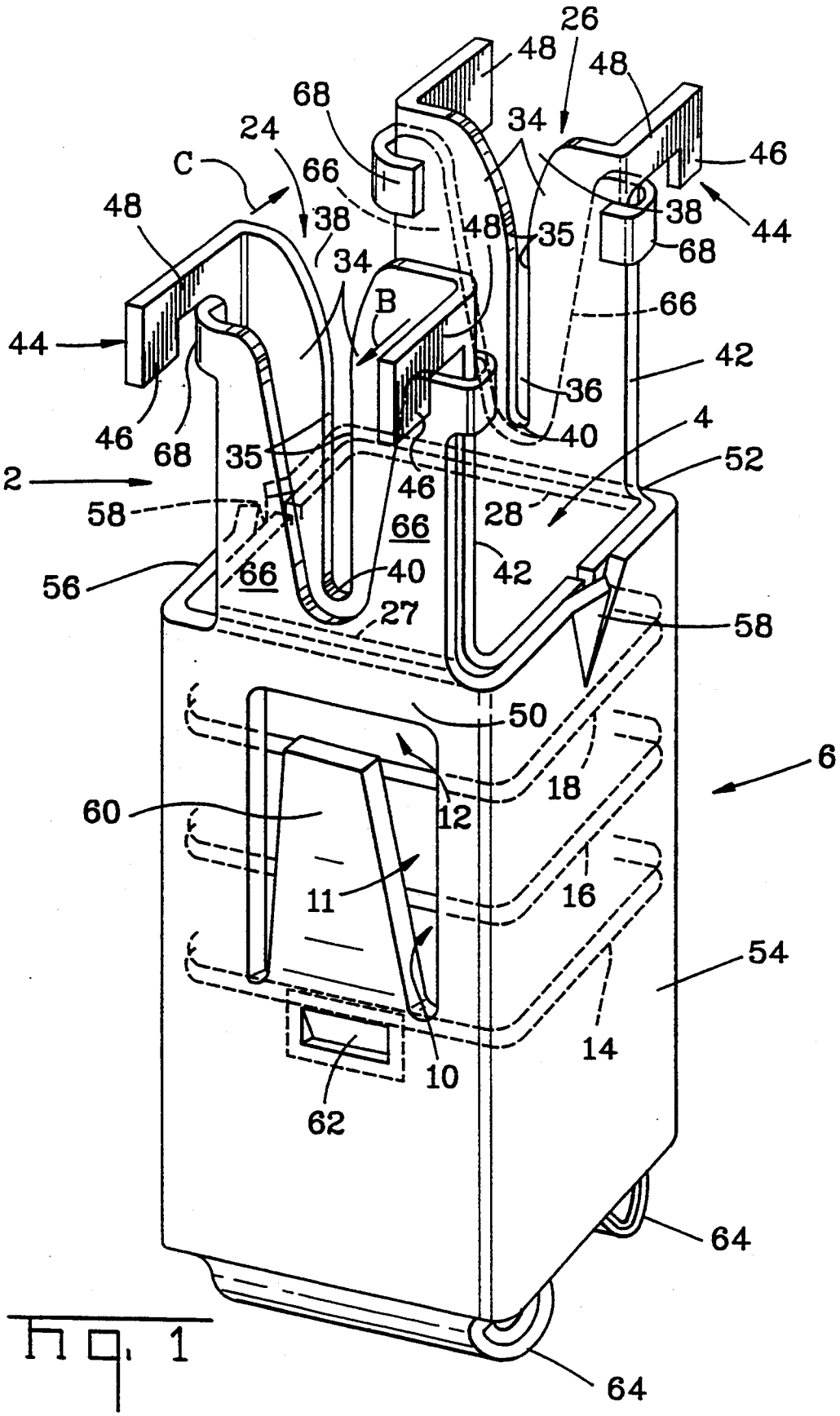

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Fig. 1

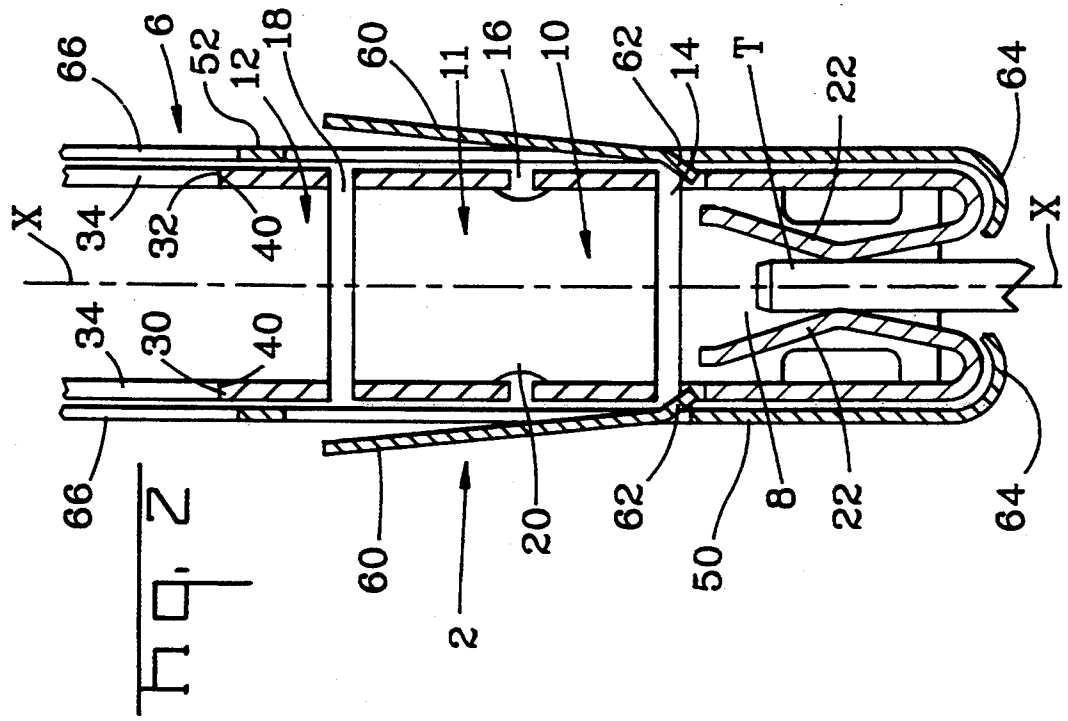

FIG. 2

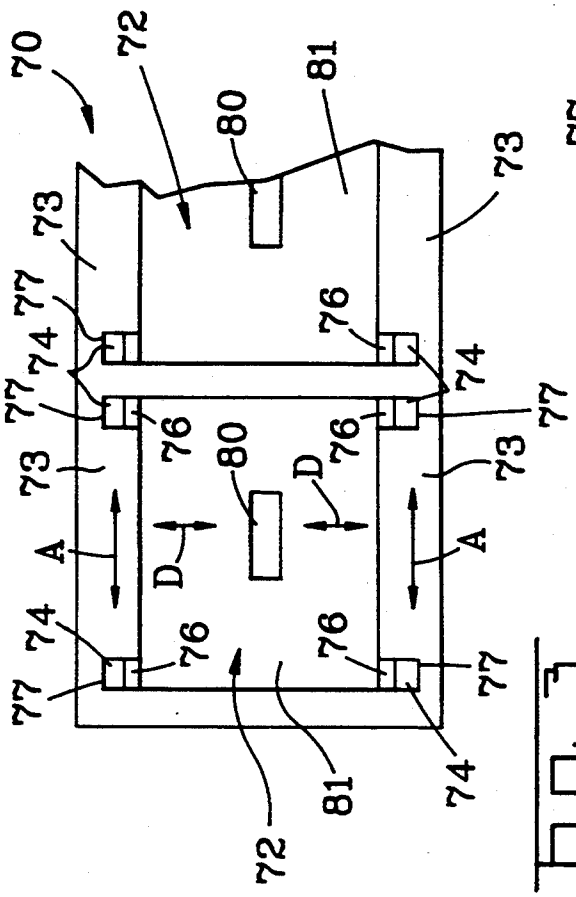

FIG. 3

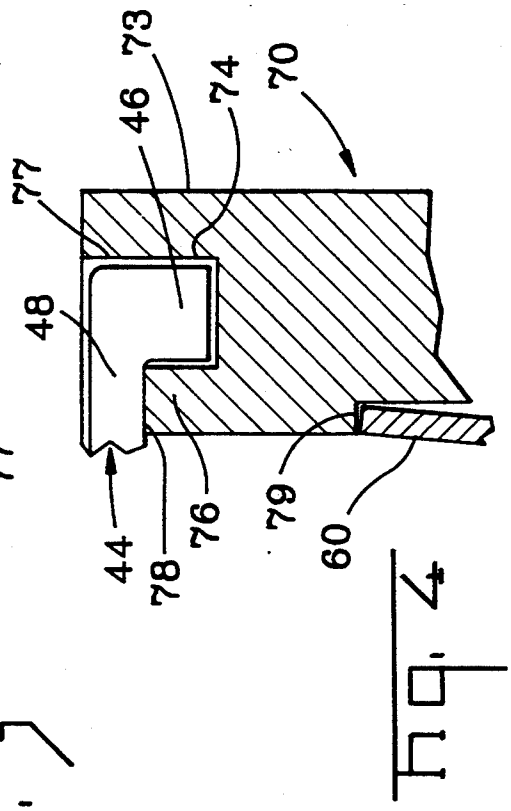

FIG. 4

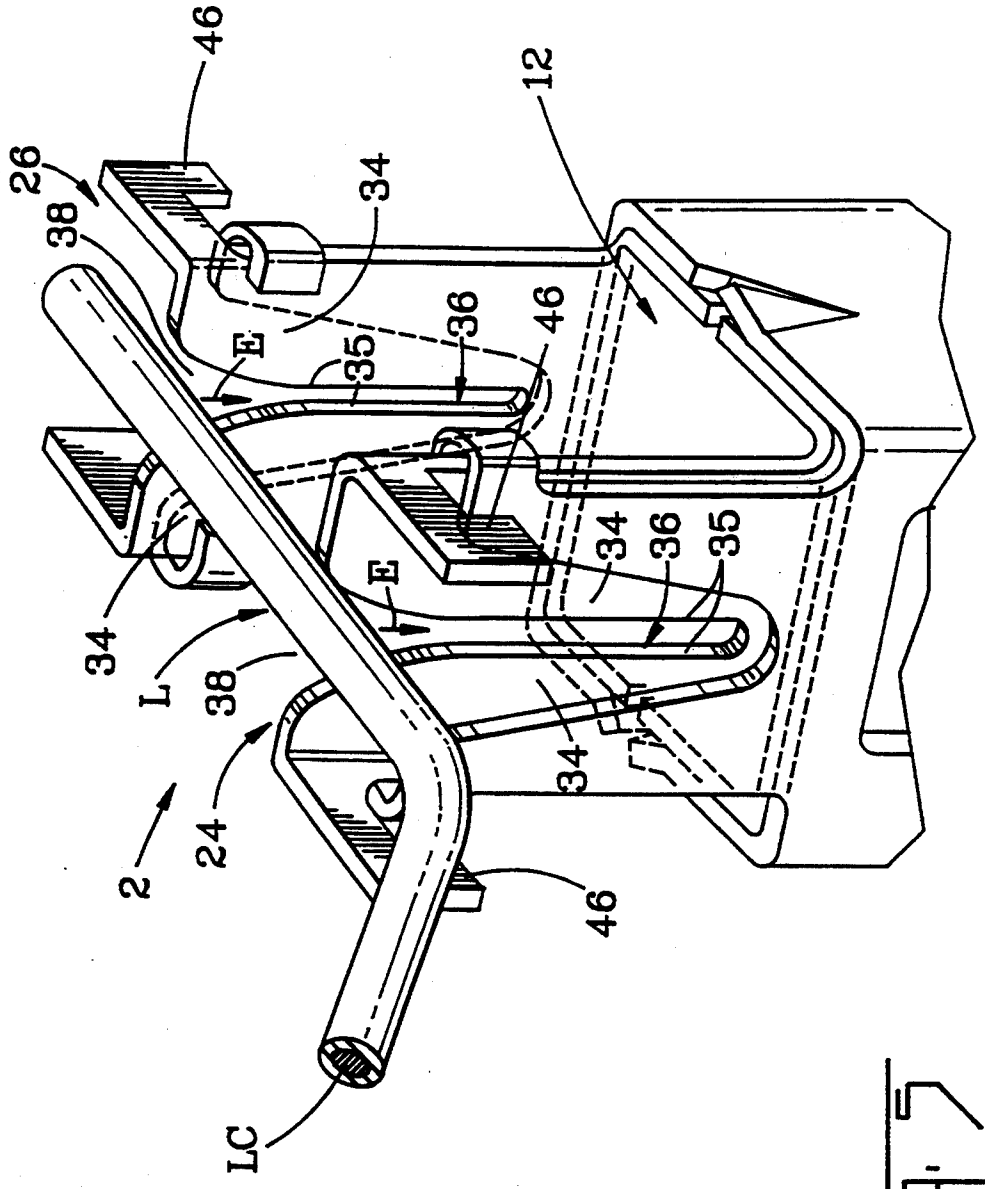

Fig. 5

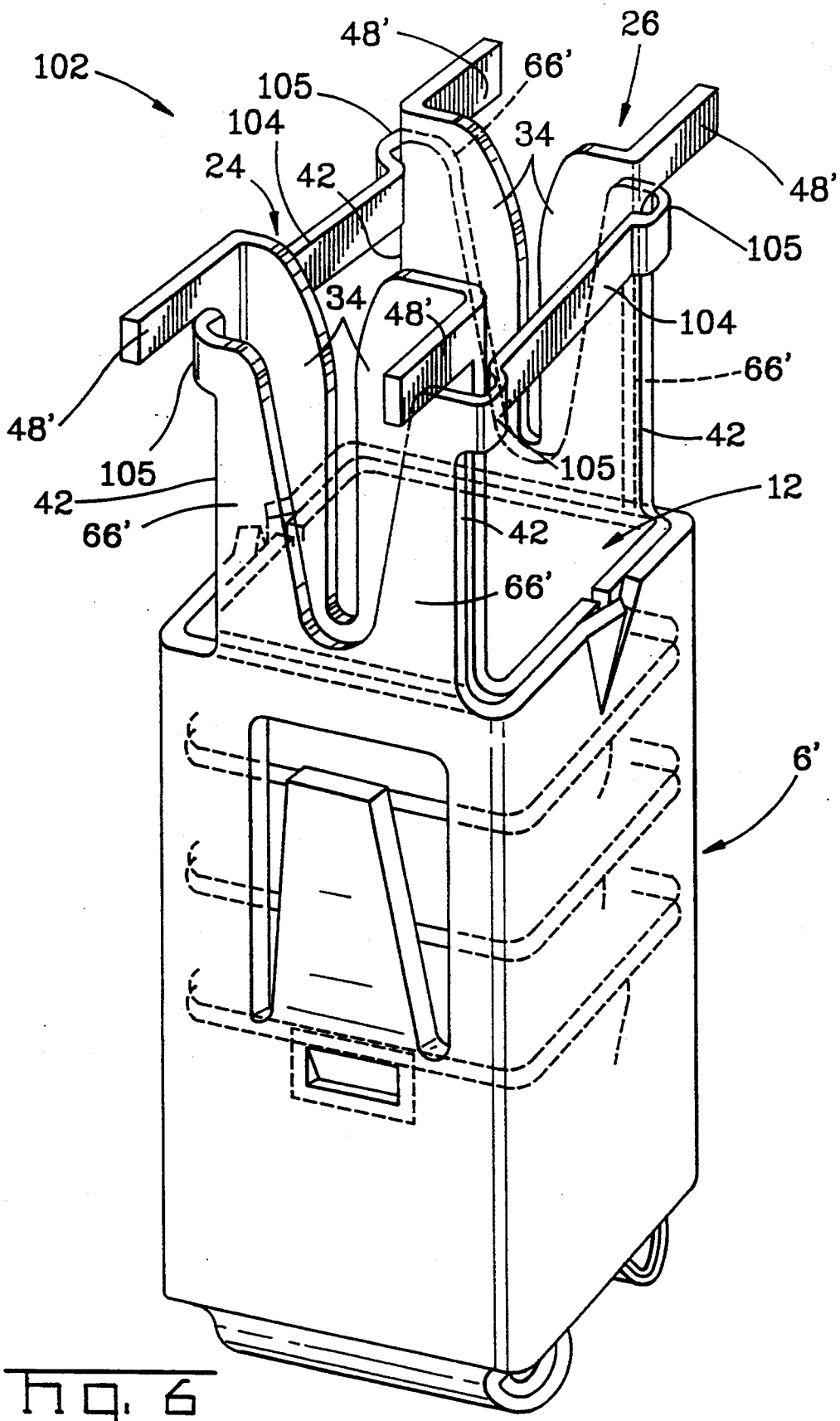
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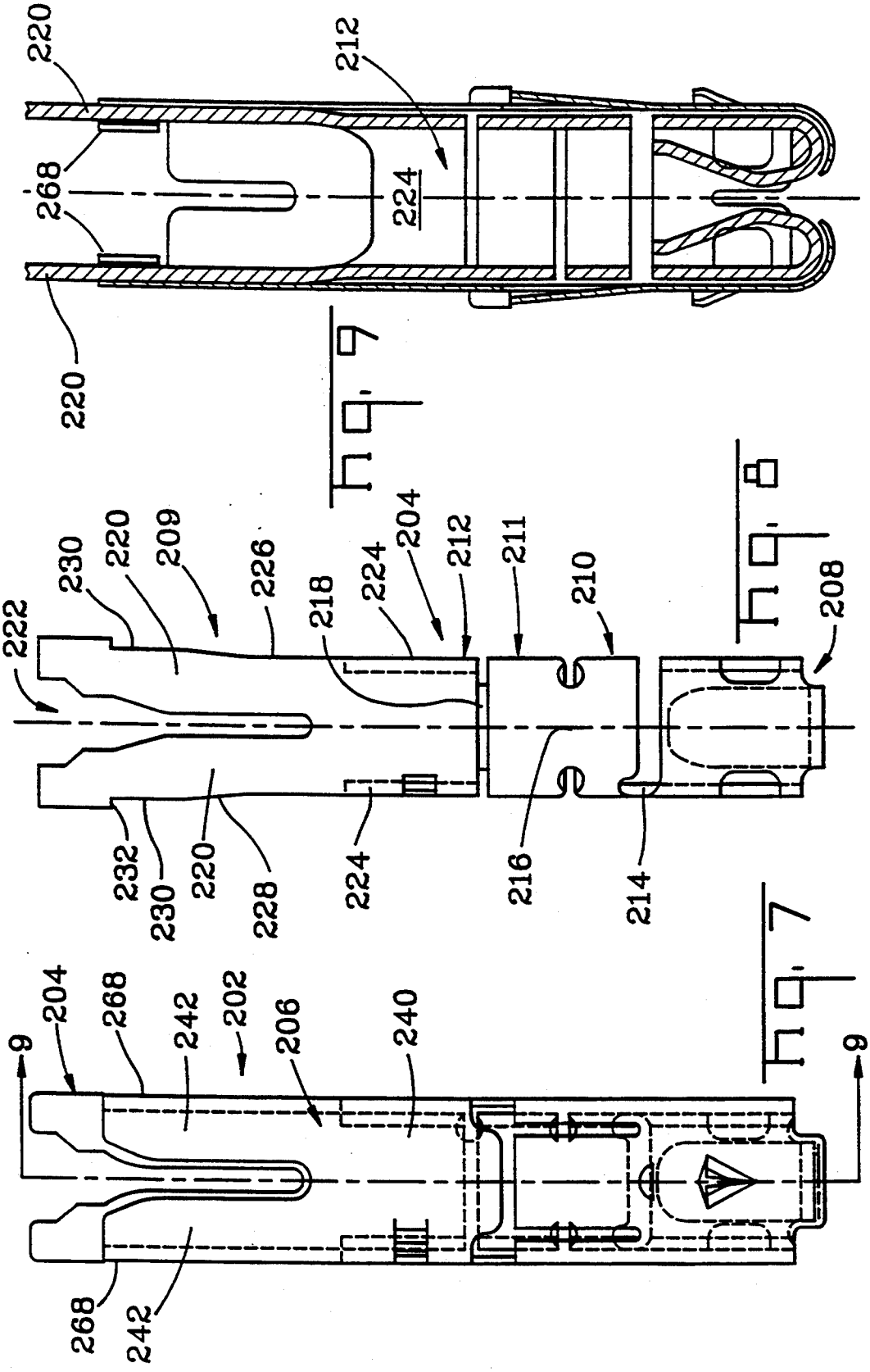
Fig. 6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INSULATION DISPLACEMENT ELECTRICAL TERMINAL ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an insulation displacement terminal assembly.

2. Description of the Prior Art

There is disclosed in U.S. Pat. No. 4,241,970 an electrical terminal assembly comprising an electrical terminal having an insulation displacement contact comprising a pair of coplanar arms projecting from a base portion and having opposed edges co-operating to define between them, a lead receiving slot opening in a direction away from the base portion.

In this known terminal assembly the base portion of the terminal is supported in a first housing. In order to insert an insulated lead into the lead receiving slot of the terminal, the lead is supported in a second housing having a slot for receiving the arms of the insulation displacement contact, and the first and second housings are mated so that the lead is forced into the lead receiving slot, so that the edges of the slot make firm electrical contact with the metal core of the lead.

It has been found that the natural tendency of the lead core under the lead insertion force is to cause one arm of the insulation displacement contact to move in a direction other than the plane of the plate forming the IDC slot and the other arm of the contact moves in the opposite sense. Such opposite displacement of the arms tends to cause the distance between the edges of the lead receiving slot to increase, thereby impairing the electrical conductivity between the lead core and the insulation displacement contact.

SUMMARY OF THE INVENTION

According to the present invention an electrical terminal assembly as defined in the second paragraph of this application is characterized by a restraining member outstanding from each arm of said insulation displacement contact and having a first end connected to said arm at a position remote from the base portion and a second end anchored to a housing receiving the terminal assembly, or being anchored to a second insulation displacement contact of the assembly; in such a way as to restrain movement of said arm, but so as to permit movement thereof in its own plane.

Thus no housing having a slot for receiving the arms of the insulation displacement contact is needed for loading the terminal assembly with a lead. The lead may, therefore, be forced into the lead receiving slot of the contact by means of conventional tool for that purpose.

According to a first embodiment of the present invention each restraining member comprises an anchoring flange which engages in a well in the housing in which the terminal assembly is received, for movement parallel to the plane of the arm to which the restraining member is connected but being immovable transversely of said plane.

According to a second embodiment of the invention, said second insulation displacement contact extends from the base portion of the terminal in spaced, parallel alignment with the first mentioned insulation displacement contact. A back-up spring cover receiving the terminal and being fixed thereto has a pair of coplanar spring arms parallel to and overlapping the arms of each

insulation displacement contact. Each restraining member connects a respective opposed pair of said spring arms and is clinched to the arms of the insulation displacement contact of a respective opposed pair of these arms. Each insulation displacement contact is thereby surrounded by a restraining structure which prevents the arms of the contact from movement in a direction other that the plane of the plate in which the IDC contact is formed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric view of an electrical terminal assembly assorting to a first embodiment of the invention;

FIG. **2** is a fragmentary longitudinal sectional view of the terminal assembly;

FIG. **3** is a top plan view of one end of an insulating housing for receiving a plurality of the terminal assemblies;

FIG. **4** is a fragmentary sectional view through part of the housing showing parts of the terminal assembly in their relation to the housing when the terminal assembly has been received therein;

FIG. **5** is a fragmentary isometric view illustrating the connection of an insulated electrical lead to the terminal assembly;

FIG. **6** is an isometric view of an electrical terminal assembly according to a second embodiment of the invention.

FIG. **7** is a side plan view of an alternate terminal according to the invention;

FIG. **8** is a similar side plan view as that of FIG. **7** showing the back-up spring removed; and

FIG. **9** is a cross-sectional view through lines **9—9** of FIG. **7**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIGS. **1** and **2**, the electrical terminal assembly **2** according to said first embodiment comprises an inner electrical receptacle terminal **4** and an outer back-up spring cover **6**.

As shown in FIG. **2**, the terminal **4** which has been stamped and formed from a single piece of sheet metal stock, comprises a tab receptacle portion **8**, intermediate body portions **10** and **11**, respectively, and a lead connecting portion **12**. The portions **8**, **10**, **11** and **12** are of box-like, substantially rectangular, cross-section. At the ends of the portions **8** and **10**, which are proximate to each other side walls of each of the portions **8** and **10** co-operate to defining a peripheral slot **14**. At the ends of the portions **10** and **11**, which are proximate to each other three side walls of each of the portions **10** and **11** co-operate to define a peripheral slot **16**, and at the ends of the portions **11** and **12**, which are proximate to each other, three side walls of each of the portions **11** and **12** co-operate to define a peripheral slot **18**. The remaining side wall of the portion **10** is connected to the remaining side wall of the portion **11** by a first web **20**, the remaining side wall of each of the portions **8** and **10**, being connected by a second and similar web (not shown) and the remaining side wall of each of the portions **11** and **12** being connected by a third and similar web (not shown). The second and third webs are connected to side walls of the portions **10** and **11** opposite to those which are connected by the first web **20**. As so for described, the terminal **4** is constructed according to the teaching of

British Patent application No 9225855.4 (40087) which is hereby incorporated herein by reference. According to that teaching, the portions **8**, **10** and **11** are relatively moveable with respect to the portion **12** about the respective webs, so that the receptacle portion **8** is displaceable in the backing spring cover **6** along the central axis X—X of the terminal assembly **2**, to prevent contact springs **22** of the portion **8** from fretting, under the action of vibration, against a tab T when it has been received between the contact springs **22**.

The lead connection portion **12** of the terminal **4** comprises a pair of insulation displacement slotted plate contacts **24** and **26**, respectively, upstanding from the upper edges **27** and **28**, respectively, of opposite side walls **30** and **32** of the lead connection portion **12** of the terminal **4**. Each contact **24** and **26** comprises a pair of arms **34** in the form of coplanar plates having inner edges **35** co-operating to define a lead receiving slot **36** having an upwardly flared lead guiding mouth **38** and a base **40**. Opposite to its edge **35**, each arm **34** has a vertical, laterally outer edge **42** which is surmounted by a restraining member in the form of a planar anchoring flange **44** projecting laterally outwardly of the terminal **4**, at right angles to the plane of the arm **34**. Each anchoring flange **44** has a downwardly projection anchoring foot **46** connected to the respective lateral edge **82** by way of a horizontal leg **48**.

The back up spring cover **6**, which has been stamped and formed form a single piece of sheet metal stock, is of rectangular, substantially square cross-section having opposite side walls **50** and **52** and opposite side walls **54** and **56**, which co-operate to enclose the box-like portions **8**, **10**, **11** and **12** of the terminal **4**. The side walls **54** and **56** of the cover **6** are clinched at **58** to respective opposite side walls of the lead connection portion **12** of the terminal **4** whereby the cover **6** is fixably attached at its upper end to the portion **12** of the terminal **4**. The side walls **50** and **52** of the cover **6** are formed with outwardly and upwardly inclined latching tongues **60** and downwardly and inwardly inclined stop tongues **62** for limiting the upward axial movement of the receptacle portion **8**. The side walls **50** and **52** also have served bottom portions **64** which overlie bight portions of the contact spring **22**, as shown in FIG. **2** in order to limit downward axial movement of the receptacle portion **8**.

There projects form the upper edge of each side wall **50** and **52** of the back-up spring cover **6** a pair of back-up spring arms **66** each of which is surmounted by a laterally outwardly projecting hook portion **68** which has been clinched about the outer edge **42** of a respective arm **34** just below its anchoring flange **44**.

As shown in FIG. **3**, an insulating housing **70** has substantially square cross-section cavities **72** which are upwardly open, each to receive a respective terminal assembly **2**. Proximate to each cavity **72**, there open into the top face of each of opposite side walls **73** of the housing **70** a pair of spaced apart wells **74** each for receiving the anchoring foot **46** of a respective anchoring flange **44**. The wells **74** of each cavity **72** are arranged proximate to the corners thereof. Between each well **74** and the respective cavity **72** is an anchoring lip having a top face **78** positioned just below the top face of the respective side wall **73**. Within each cavity **72**, each of the opposite side walls **73** of the housing **70** is formed with a latching shoulder **79** for engagement by the free end surface of a respective latching lance **60**, as shown in FIG. **4**. The bottom wall **81** of each cavity **72** is formed with a through hole **80** for receiving a respective tab T.

Each terminal assembly **2** is assembled to the housing **70** by inserting the assembly **2** into its respective cavity **72** through the open top thereof, with the curved portions **64** of the assembly **2** leading, with the foot **46** of each anchoring tab **44** aligned with a respective well **74** and the opening between the contact springs **22** aligned with the hole **80** in the bottom wall **81** of the cavity **72**. Thus in the fully inserted position of the assembly **2**, the foot **46** of each anchoring flange **44** is received in its respective well **74** with the leg **48** of the anchoring flange **44** abutting the top face of the adjacent lip **76**, as shown in FIG. **4** and the end face of each latching tongue **60** overlying a respective latching shoulder **78**, whereby withdrawal of the assembly **2** from its cavity **72** is prevented. In the fully inserted position of the terminal assembly **2**, each insulation displacement contact **24** and **26** is spaced from the respective side wall **73** of the housing **10**, by means of its leg **48**. The wells **74**, and the feet **46** are so relatively dimensioned, that each foot can move laterally in its well **74**, that is to say towards and away from the other foot **46** of the same insulation displacement contact, as shown by arrows A in FIG. **3**. Since each foot **46** is received within its respective well **74** and confined therein by the respective lip **76** and the wall **77** opposite thereto, as best seen in FIG. **4**, movement of the arms **34** is prevented from occurring in the directions of arrow B and arrow C (FIG. **1**) and double arrows D (FIG. **3**).

When each terminal assembly **2** has been received in its cavity **72** as described above, an insulated electrical lead L (FIG. **5**) is inserted by means of a lead insertion tool (not shown) into the lead receiving slots **36** of the insulation displacement contacts **24** and **26** by way of the lead guiding mouths **38**. The lead L is so inserted in a direction at right angles to its length, that is to say in the direction of the arrows E in FIG. **5**. As the lead is inserted into the slots **36**, the edges **35** thereof displace the insulation of the lead and make firm electrically conducted contact with the central metal core LC of the lead L. The arms **34** of each of the contacts **24** and **26** are forced apart by the core LC of the lead so that the feet **46** move laterally in their wells **74** in the direction of the arrows A in FIG. **3** as described above and the spring arms **66** being deflected in their own planes. Since the feet **46** cannot move in the direction indicated by the arrows D, that is either towards or away from the cavity **72** the arms **34** of each contact **24** and **36** remain in their coplanar relationship so that the edges **35** of each slot **36** remain in facing and aligned relationship with each other, even after the lead L has been fully inserted to a position proximate to the bases **40** of the slots **36**, the lead L extending in a direction at right angles to the common plane of the arms **34**. The back-up spring arms **66** serve to maintain the contact force between the slot edges **35** and the lead core LC, despite vibration or temperature changes to which the terminal assembly may be subjected when in use. The legs **48**, the bottom edges of which engage the top faces **78** of the lips **76** serve to counteract the lead insertion force.

Absent, the provision for retaining the feet **46** against movement in the direction of the arrows D, the natural tendency of the core LC under the lead insertion force would be to cause one arm **34** of each contact **24** or **26** to be torsionally and angularly displaced about its vertical axis either in the sense indicated by the arrow B in FIG. **1** and the other arm **34** to be similarly but oppo-

sitely displaced in the sense indicated by the sense indicated by the arrow C in FIG. 1 or vice-versa, given the resilient nature of the back-up spring arms 66. Such angular movement of the arms 34 would cause the lead L to be horizontally angularly displaced in the slots 36 whereby the edges thereof would tend to shear the lead core LC and so reduce its electrical conductivity as will as the tensile strength of the mechanical connections between the core LC and the contact 24 and 26.

The second embodiment of the invention will now be described with particular reference to FIG. 6 in which parts which are the same as corresponding parts which has been described above, bear the same reference numerals thereas and parts which have a similar function to corresponding parts described above bear the same reference numerals thereas but with the addition of a prime symbol.

The terminal assembly 102 as shown in FIG. 6 is the same as that of the first embodiment, excepting that the feet 46 of the first embodiment have been omitted and the back-up spring arms 66' of the back-up spring cover 6' instead of having hook portions 68 clinched about the outer edges 42 of the arm 34 are connected by means of restraining members in the form of straps 104 extending form their upper ends. Each strap 104 connects a respective back-up spring arm 66' of the insulation displacement contact 24 to the opposite back-up spring arm 66' of the insulation displacement contact 26. The straps 104 are clinched at 105 about the laterally outer edges 42 of the arms 34 of the contacts 24 and 26, just below the legs 48' thereof which are devoid of the feet 46. The straps 104 and the back-up spring arms 66' thus co-operate to provide a box-like structure about the arms 34 so that the angular torsional movement thereof mentioned above is prevented. By virtue of the straps 104, angular torsional movement of the spring arms 66' which would allow similar movement of the arms 34 is prevented. When the assembly 102 is disposed in the cavity 72 of the housing 70, the bottom edges of the legs 48' engage the top faces 78 of the lips 76 and thus counteract the lead insertion force. In this embodiment the wells 74 can be omitted.

With respect now to FIGS. 7–9, an alternate embodiment of the terminal is shown at 202 including an inner contact portion 204 surrounded by an outer backup spring at 206. The inner terminal 204 is shown best in FIG. 8 as including a receptacle portion at 208 interconnected to the wire connecting section 209 via box shaped sections 210,211 and 212. It should be appreciated that the receptacle portion 208 is interconnected to the box shaped portion 210 by way of a web of material at 214. Similarly the box shaped portions 210 and 211 are interconnected to each other by way of a web of material at 216, whereas the box-shaped portions 211 and 212 are interconnected to each other by way of the web of material 218. As shown best in FIG. 8, as the webs of material 214, 216 and 218 are formed from different side walls of the rectangular terminal shaped member 204, the terminal has two degrees of freedom for movement to accommodate for vibratory movement.

The insulation displacement portion 209 is defined by two legs 220 on each side to form a wire receiving slot 222. The leg members 220 upstand beyond a side wall 224 forming the box shaped portion 212 as shown best in FIG. 9. As also shown in FIG. 8, the outer edges of the leg members 220 include edges 226, diverging edges 228 and upper edges 230 forming a stepped end at 232. The outer backup spring 206, shown in FIG. 7, is similar to that shown in FIG. 1, having a rear box portion 240 having upstanding backup arms 242 where the arms include outwardly projecting hook members 268 as shown in FIG. 9. These hook members 268 grip along side edges 230 of the IDC leg portions 220 thereby providing a backup force.

In the preferred embodiment of the invention, the distance between the inner surfaces of the hook portions 268 which engage the side edges 230 of the same slot is less than the distance between the corresponding side edges 230, such that the assembly of the backup spring member 206 over the terminal shown in FIG. 8 forces the leg members 220 towards each other, to preload the insulation displacement slot 222.

We claim:

1. An electrical connector assembly comprising a connector terminal assembly including an electrical terminal having an insulation displacement contact with a pair of arms projecting from a base portion and having opposed edges cooperating to define between them a lead receiving slot opening in a direction away from the base portion, where a restraining member that includes an anchoring flange having a leg connected to said arms and terminating in a foot depending therefrom; and a housing having a cavity wherein the terminal assembly is seated and including wells adjacent the cavity such that the foot of the restraining member is received in the corresponding well in such a way as to restrain torsional movement of said arms, but so as to permit movement thereof in their own plane.

2. An electrical terminal assembly comprising an electrical terminal having a base portion with an insulation displacement contact and comprising a pair of resilient arms projecting from a base portion having opposing edges defining a lead receiving slot opening away from the base portion, a cover affixed to the electrical terminal and a spring arm extending from the cover and along each of the resilient arms having a restraining member overlapping and cooperating with the resilient arm in such a way as to restrain torsional movement of said arm, but so as to permit movement thereof in its own plane.

3. An assembly as claimed in claim 1, characterized in that the leg extends from an outer edge of said arm, said leg and said foot being coplanar and extending at right angles to said arm.

4. An assembly as claimed in claim 1 or 3, characterized in that the housing has a cavity having an open end and receiving said terminal assembly, the well being formed in a surface of the housing bounding the open end thereof, and the leg abutting a lip between the well and the cavity.

5. An assembly as claimed in claim 1, characterized in that the terminal assembly further comprises a back up spring cover receiving the terminal and being fixed thereto, said cover having a pair of coplanar spring arms coplanar with the arms of said insulation displacement contact, each spring arm, being clinched to a respective arm of said insulation displacement contact proximate to the restraining member thereof.

6. An assembly as claimed in claim 1, characterized in that a second insulation displacement contact extends from the base portion of the terminal in spaced, parallel, alignment with the first mentioned insulation displacement contact, the terminal assembly further comprising a back-up spring cover receiving the terminal and being fixed to the base portion, said cover having a pair of

coplanar spring arms parallel to, and overlapping the arms of each insulation displacement contact, each restraining member connecting a respective opposed pair of said spring arms and being clinched to the insulation displacement contact arms of a respective opposed pair thereof.

7. An assembly as claimed in claim 6, characterized in that each restraining member is formed integrally with the spring arms of the respective pair of opposed pair of such arms and extends therebetween as a rectilinear strap, each spring arm being closely adjacent to a respective insulation displacement contact arm.

8. An assembly claimed in claim 6 or 7, characterized in that a planar leg extends from an outer edge of each insulation displacement contact arm proximate to a free end thereof remote from the base portion, at right angles to the plane of that arm, the legs of one of the insulation displacement contacts extending in the opposite direction to those of the other insulation displacement contact.

9. An assembly as claimed in claim 8, characterized in that the housing has a cavity having an open end and receiving said terminal assembly, an edge of each of the legs of each insulation displacement contact engaging an abutment surface recessed below a respective surface of the housing, bounding said open end thereof.

10. An assembly as claimed in claim 6 characterized in that said restraining members and said spring arms cooperate to provide a box-like restraining structure about said insulation displacement contacts.

11. An electrical terminal assembly comprising an electrical terminal having an insulation displacement contact comprising a pair of resilient arms projecting from a base portion and having opposed edges cooperating to define between them a lead receiving slot opening away from the base portion characterized in that a back-up spring cover is received upon the terminal and is fixed thereto, said cover having a pair of coplanar spring arms extending parallel to, and overlapping, the resilient arms of the insulation displacement contact, the spring arms including a restraining member to cooperate with the resilient arms so that the resilient arms are constrained in such a way as to restrain torsional movement of said resilient arms, but so as to permit movement thereof in its own plane.

12. The electrical terminal assembly of claim 11, further characterized in that the spring arms include a restraining member clinched to the insulation displacement contact arms of a respective opposed pair thereof.

13. The electrical terminal assembly of claim 12, further characterized in that each of the opposed pair of resilient arms include an outer edge that is located opposite the opposed edge that defines the lead receiving slot, said restraining member being clinched about said outer edge.

14. The electrical terminal assembly of claim 11, further characterized in that the terminal assembly includes a second set of resilient arms defining another lead receiving slot aligned with the other lead receiving slot.

15. The electrical terminal assembly of claim 14, further characterized in that a back-up spring cover is received upon the terminal and is fixed thereto, said cover having a pair of coplanar spring arms corresponding to each pair of resilient arms and extending parallel thereto, and overlapping, the arms of the insulation displacement contact, the spring arms including a restraining member being clinched to the insulation displacement contact arms of a respective opposed pair thereof.

16. The electrical terminal assembly of claim 15, further characterized in that each restraining member is formed integrally with the spring arms of the respective pair of opposed pair of such arms and extends therebetween as a rectilinear strap, each spring arm being closely adjacent to a respective insulation displacement contact arm.

17. The electrical terminal assembly of claim 12, further characterized in that the resilient arms are biased inward towards each other in a preloaded manner by the spring arms.

18. The electrical connector assembly of claim 2, further comprising a second pair of resilient arms defining a second slot aligned with the first slot and wherein the corresponding spring arms are interconnected by a rectilinear strap.

* * * * *